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Response After Final

REMARKS

Claims 1-11, 16, 17, 19, 21-32, 34-39, 41-76, and 85 are pending in the application. The Examiner has withdrawn Claims 38-43, 51-54, and 77-84 from consideration as being drawn to a non-elected species.

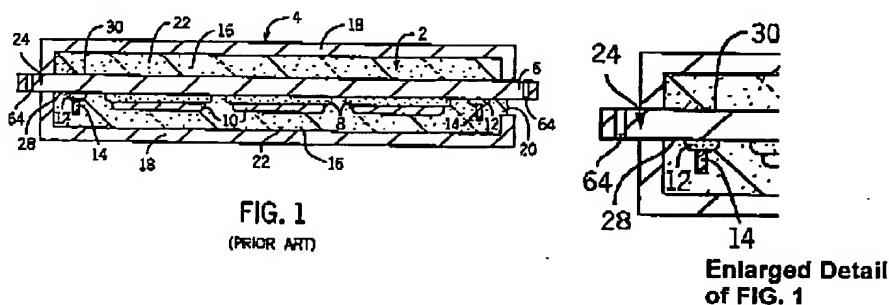
Claims 1, 9, 21, 23-24, 26-27, 29, 32, 34-39, 41, 43-53, 55-59, 61-63, and 73-74 have been amended. Claims 12-15, 18, 20, 33, 40, and 77-84 have been canceled. New Claim 85 has been added. No new matter has been added with the amendment of the claims. The amendments are intended to merely clarify language used in the claims and the subject matter claimed, and the scope of the claims is intended to be the same after the amendment as it was before the amendment.

Rejection of Claims Under 35 USC § 102(b) (APA)

Claims 1, 9-25, 27-29, 34-36, 44-46, 48-50, and 55-76 stand rejected under § 102(a) as being anticipated by "Admitted Prior Art" (APA) in FIGS. 1-2 and Applicant's specification at pages 1-2. Insofar as this rejection is maintained with respect to the claims as amended, this rejection is respectfully traversed.

Claims 1, 24, 29, 34, 38, 44, 48, 51, 53, 55-58, 61-63, and 73-74 have been amended to more clearly recite that the molded stiffener is secured to the substrate without attachment with an adhesive element.

The prior art device described by Applicant in the specification at pages 1-2 has a stiffener (14) attached to a substrate (6) by means of an adhesive element (12). This prior art configuration is clearly shown in Applicant's FIG. 1 and described in the specification at page 1, lines 12-20 (emphasis added).



Referring to FIG. 1, a prior art semiconductor die package 2 disposed within a package mold 4 is shown. Package 2 typically comprises a lead frame 6 (or other substrate), adhesive element 8, one or more dies 10, adhesive element 12, a metal or plastic stiffener 14, and an encapsulating material 16...

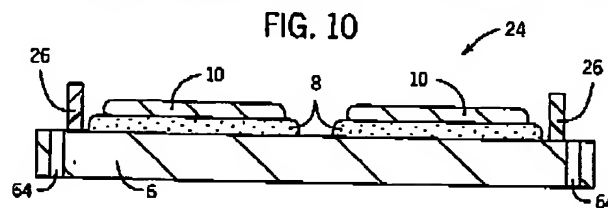
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The package illustrated in FIG. 1 can be assembled by first constructing a die assembly 24. ...After die assembly 24 is assembled, plastic or metal stiffener 14 is secured to lead frame 6 of die assembly 24 with adhesive element 12, ...

As depicted in FIG. 1 above, stiffener (14) is attached by adhesive element (12) to substrate (6). This is not Applicant's device as described and claimed.

Applicant's device includes a stiffener (26) that is formed *directly onto* a substrate (6) by a molding process – resulting in a "molded stiffener" on the substrate. That molded stiffener is secured on the substrate without attachment by an adhesive element. This feature is illustrated, for example, in FIG. 10 below, and described in the specification, for example, at page 4, lines 15-18, page 8, lines 22-24, and page 9, lines 18-19 (emphasis added):



Another aspect of the invention provides a method of securing a stiffener to a substrate. The method can comprise the steps of providing a stiffener material and a substrate, *molding the stiffener material to the substrate, and permitting the stiffener material to harden to form a molded stiffener secured to the substrate...*

...
Instead of molded stiffener 26 being secured to lead frame 6 using an adhesive element 12 (e.g., a strip of adhesive tape or a layer of adhesive paste) as used with prior art stiffeners, molded stiffener 26 can be molded directly to the lead frame....

...Thus, molded stiffener 26 is secured to lead frame 6 without the need for a separate step involving the application of an adhesive element 12 (FIG. 1).

Unlike the prior art devices, the stiffener in Applicant's device is molded directly onto a substrate – *eliminating* the need for an adhesive element to attach the stiffener to the substrate. This advantageously eliminates the (prior art) adhesive element from the device construction. It also *combines* the (prior art) steps of first forming and then attaching a stiffener to a substrate into a *single step* by molding the stiffener directly onto the substrate to both form and secure the stiffener to the substrate.

The "Admitted Prior Art" (APA) disclosed in Applicant's specification at pages 1-2 and illustrated in FIGS. 1-2, does not teach or suggest a stiffener that is molded onto and secured to a substrate *without* an adhesive element. Accordingly, withdrawal of this rejection of the claims is respectfully requested.

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Rejection of Claims Under 35 USC § 103 (APA with Lim)

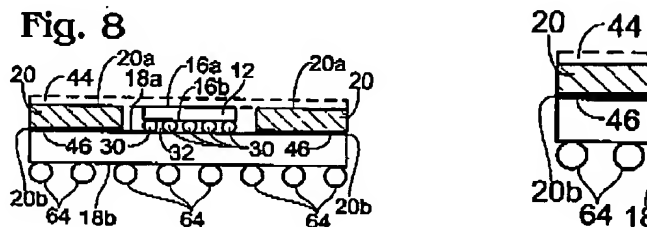
The Examiner maintained the rejection of Claims 2-8, 11, and 37 as obvious over the "Admitted Prior Art" (APA) in view of USP 6,020,221 (Lim). Insofar as this rejection is maintained with respect to the claims as amended, this rejection is respectfully traversed.

The Examiner cites Lim for teaching a substrate made of the recited materials, and maintains that it would be obvious to construct a substrate with the recited thicknesses.

Claims 2-8 and 11 depend from amended Claim 1, and Claim 37 depends from amended Claim 34. Both Claims 1 and 34 recite that the stiffener is molded onto and secured to the substrate without attachment with an adhesive element.

Lim's disclosure of substrate materials fails to cure the base deficiency of the "Admitted Prior Art" (APA), in teaching Applicant's device and methods as claimed. As stated above, the "APA" teaches the attachment of a stiffener to a substrate with an adhesive element, and Lim's disclosure does not correct that deficiency.

Furthermore, like the "Admitted Prior Art" (APA), Lim discloses an assembly in which a stiffener (20) is attached to a substrate *by an adhesive element (46)*. Lim's construction is illustrated in FIG. 8 (below), and described at col. 5, lines 44-47 (emphasis added).¹



Enlarged Detail of FIG. 8

The...stiffener member 20 is joined to the...substrate 14 by adhesive material 46, typically an epoxy resin adhesive material....

The APA and Lim, either alone or in combination fail to teach or suggest a device having stiffener molded onto and secured to the substrate without attachment with an adhesive element, as claimed by Applicant. Accordingly, withdrawal of the rejection of Claims 2-8, 11, and 37 is respectfully requested.

¹ Also, see Lim at col. 4, lines 42-50. "Turning now to FIG. 2, ...A stiffener member 20 is attached to a major surface of substrate 14. Typically, this is accomplished by dispensing an epoxy resin on top of the substrate

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Rejection of Claims Under 35 USC § 103 (APA with Culnane)

The Examiner maintained the rejection of Claims 26, 30-33, and 47 as obvious over the "Admitted Prior Art" (APA) in view of USP 6,517,662 (Culnane). Insofar as this rejection is maintained with respect to the claims as amended, this rejection is respectfully traversed.

The Examiner cites to Culnane for teaching a device with (a) a "stiffener" (solder balls 13) secured within a recess (9) of a substrate (Claim 26), (b) two stiffeners (10, solder balls 13) of different configurations or dimensions (Claims 30-31), (c) a stiffener (10) protruding from the substrate and a second "stiffener" (solder balls 13) within a recess (9) and flush with the surface of the substrate (Claim 32), and (d) bonding a stiffener to the substrate by heating, cooling and curing (Claim 47).

The claims recite that the stiffener is molded onto and secured to the substrate without attachment with an adhesive element. The proposed combination of Culnane with the "Admitted Prior Art" (APA) does not cure the base deficiency of the "APA" in teaching Applicant's device and methods as claimed. As stated above, the "APA" teaches the attachment of a stiffener to a substrate with an adhesive element, and Culnane's disclosure does not correct that deficiency.

Like the "Admitted Prior Art" (APA), Culnane teaches attaching a stiffener (10) to a flexible substrate (4) by an adhesive element (20). Culnane's construction is illustrated in FIGS. 1-2 (below), and the attachment of the stiffener (10) by adhesive (20) is described, for example, at col. 4, lines 26-43 (emphasis added).

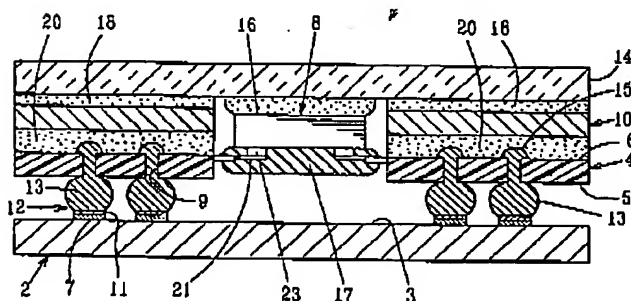


FIG. 1

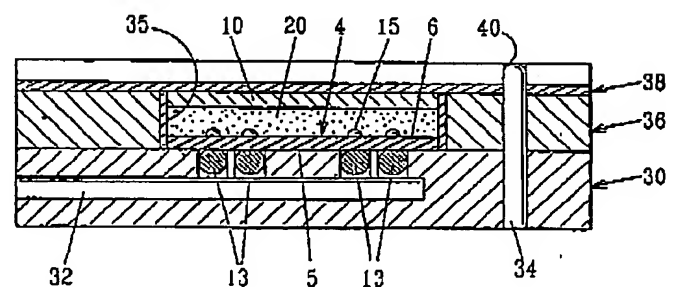


FIG. 2

Obviously, the flexible substrate 4 must be bonded to the stiffener 10...

An adhesive composition 20 provides the critical bonding between flexible substrate 4 and stiffener 10 without electrical communication therebetween.

14...Stiffener member 20 is then placed on top of the epoxy resin and substrate 14. By applying heat and pressure

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In fact, the focus of Culnane's disclosure is the development of an adhesive that solves problems associated with a flexible substrate to a stiffener using conventional adhesives. See, in particular, Culnane at col. 1, line 30 to col. 2, line 14, which goes into detail to describe the problems with existing adhesives in a substrate – stiffener assembly.

With respect to Claims 30-32, the Examiner apparently contends that the solder balls (13) function as a secondary stiffener in Culnane's device. The Examiner states in the Office Action at page 6, paragraph 4:

...Also the stiffeners 13 or solder balls 13 are different from the stiffeners 13, wherein the first stiffeners are disposed on one side of the substrate 4 and the stiffeners 13 are disposed on the other side of the substrate 4 (fig. 1)....

The Examiner's position is incorrect and without basis.

As described by Culnane and others in the art,² a stiffener is an element that is structured and functions to provide *structural and mechanical support* to a substrate (which is a flexible substrate, e.g., thin polyimide tape, in Culnane's device). The Examiner is directed to Culnane's description of the stiffener, which is provided at col. 1, lines 26-29, col. 2, lines 40-53, and col. 4, lines 18-24, and illustrated in FIG. 1 (and FIG. 2 above).

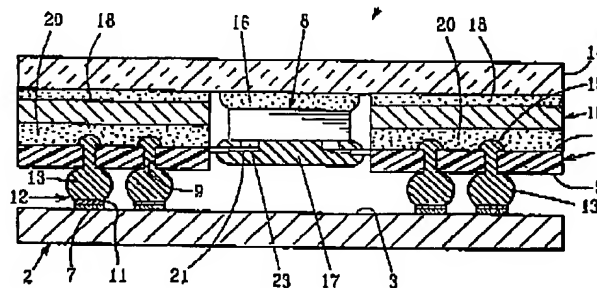


FIG. 1

The aforementioned assembly requires the inclusion of a metal stiffener to provide adequate structural support for the very thin polyimide tape which constitutes the flexible circuit substrate...

...

to the composite structure...bonding between the stiffener member 20 and the substrate 14 will be effected."

² See Lim, for example, at col. 2, lines 38-45: "...A stiffener member, which is attachable to the semiconductor package substrate, is employed for purposes of minimizing package warpage. The stiffener member is attached to the semiconductor package substrate to provide the requisite support for the semiconductor package substrate during the assembly process and thereby counteract the sources of the package warpage problem."

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In accordance with the present invention, a semiconductor chip carrier assembly is provided.*A stiffener is included to support the flexible substrate.* The stiffener, having a first and a second surface, is disposed such that the first surface of the stiffener is adjacent the surface of the flexible substrate...

...
The very thin nature of the flexible substrate 4 emphasizes the *requirement that it be structurally supported. This support is provided by a stiffener 10...* All that the material need provide is adequate strength *such that the flexible substrate 4 is mechanically supported...*

The solder balls (13) in Culnane's device do not function as a "stiffener" as that element is known and understood in the art. This is clear from Culnane's statements describing prior art TBGA assemblies that have a substrate *with attached solder balls – but require a stiffener to provide adequate structural support.* See Culnane's description of the prior art assemblies at col. 1, lines 16-29 (emphasis added).

It is well known in the art to electrically connect a semiconductor chip to a circuit board by employing a carrier structure for the semiconductor chip. One well accepted chip carrier assembly design for providing this electrical connection is a tape ball grid array type assembly (TBGA). A TBGA assembly is electrically connected to a circuit board *by means of solder balls.* This electrical connection is accomplished by connecting the solder balls of the chip assembly to electrical connecting pads on the circuit board.

The aforementioned assembly requires the inclusion of a metal stiffener to provide adequate structural support for the very thin polyimide tape which constitutes the flexible circuit substrate.

A chip carrier assembly stiffener is bonded to the polyimide tape substrate by means of an adhesive...

Clearly, solder balls (13) attached to a substrate (4) do not reinforce or stiffen the substrate or provide mechanical and structural support that is comparable to a stiffener (10). The solder balls (13) are not equivalent to the stiffener (10) in Culnane's device.

The Examiner's contention that solder balls (13) function as a stiffener in Culnane's device — as that element is used and understood in the art, is clearly without basis.

The references alone or in combination fail to teach or suggest a device having stiffener molded onto and secured to the substrate *without attachment with an adhesive element*, as claimed by Applicant. Accordingly, withdrawal of the rejection of Claims 26, 30-33, and 47 is respectfully requested.

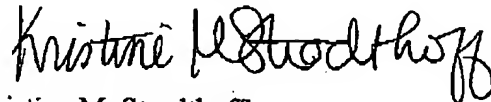
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Extension of Term. The proceedings herein are for a patent application and the provisions of 37 CFR § 1.136 apply. Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that Applicant has inadvertently overlooked the need for a petition for extension of time. If any extension and/or fee are required, please charge Account No. 23-2053.

It is respectfully submitted that the claims are in condition for allowance and notification to that effect is earnestly solicited. The Examiner is urged to telephone the undersigned attorney if any questions should arise.

Respectfully submitted,



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